IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strikethrough~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered). Please AMEND claims * and ADD new claims * in accordance with the following:

1.   (currently amended) In a method of removing noise from a digital image, comprising ~~the steps of~~:

a)   receiving an original digital image including a plurality of pixels;

b)   generating at least one residual digital image and at least one base digital image from the original digital image, the base digital image having a lower spatial resolution than the original digital image; and

c)   generating a noise reduced base digital image by removing noise from the base digital image with a noise reduction filter so that when the noise reduced base digital image is combined with the residual digital image to produce a reconstructed digital image, noise is ~~not present~~ reduced in the reconstructed digital image as compared to the original digital image.

2.   (currently amended) The method of claim 1 further including ~~the step of~~:

d)   using the residual digital image and the noise reduced base digital image to produce the reconstructed digital image.

3.   (original) The method of claim 2 wherein the reconstructed digital image has the same spatial resolution as the original digital image.

4.   (original) The method of claim 2 wherein the reconstructed digital image has a lower spatial resolution as the original digital image.

5.   (currently amended) The method of claim 2 further including ~~the step of~~ further removing noise from the reconstructed digital image by using the noise reduction filter.

6.   (currently amended) The method of claim 2 further including ~~the steps of~~:

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generating an interpolated base digital image by spatially filtering the base digital image with an interpolation filter; and

generating the residual digital image by combining the interpolated base digital image with the original digital image.

7.   (original) The method of claim 6 wherein combining the interpolated base digital image with the original digital image includes calculating the difference between the interpolated base digital image and the original digital image.

8.   (original) The method of claim 6 further including:

generating an interpolated noise reduced base digital image by spatially filtering the noise reduced base digital image with the interpolation filter; and

generating the reconstructed digital image by combining the residual digital image and the interpolated noise reduced base digital image.

9.   (original) The method of claim 8 wherein combining the residual digital image with the interpolated noise reduced base digital image includes calculating the addition of the residual digital image and the interpolated noise reduced base digital image.

10.   (withdrawn) The method of claim 2 wherein the generated base digital image is accomplished by spatially filtering the original digital image.

11.   (withdrawn) The method of claim 10 wherein the generated base digital image is accomplished by spatially filtering the original digital image using a two-dimensional Gaussian filter.

12.   (withdrawn) The method of claim 10 wherein the generated base digital image is accomplished by spatially filtering the original digital image using two one-dimensional Gaussian filters wherein the one-dimensional Gaussian filters are oriented in orthogonal directions to each another.

13.   (withdrawn) The method of claim 10 wherein the generated base digital image is accomplished by spatially filtering the original digital image wherein the spatial filtering step is applied to selected pixels of the original digital image.

14. (withdrawn) The method of claim 13 wherein the selected pixels on which spatial filtering is performed on every other pixel of every other row of pixels of the original digital image.

15. (currently amended) The method of claim 1 wherein the noise reduction filter used to remove noise from the base digital image includes ~~the steps of~~:

identifying a pixel of interest and a local neighborhood of pixels located about the pixel of interest;

calculating a difference pixel value for pixels in the local neighborhood of pixels based on the absolute difference between the value of the pixel of interest and the individual values of pixels included in the local neighborhood of pixels;

using the absolute difference pixel values to calculate a noise reduced pixel value; and

replacing the value of the pixel of interest with the noise reduced pixel value.

16. (currently amended) The method of claim 15 further including ~~the steps of~~:

comparing the absolute difference pixel values to a threshold value; and

using only the values of pixels included in the local neighborhood of pixels for which the corresponding absolute difference pixel values are less than the threshold value to calculate the noise reduced pixel value.

17. (original) The method of claim 16 wherein the threshold value is a function of the values of pixels included in the local neighborhood of pixels.

18. (original) The method of claim 1 wherein the noise reduction filter is adaptive and changes in response to the signal content of the pixels values of the digital image.

19. (original) The method of claim 1 wherein the noise reduction filter is a median filter.

20. (original) The method of claim 6 wherein the interpolation filter is a bilinear interpolation filter.

21. (original) The method of claim 6 wherein the interpolation filter is a bicubic interpolation filter.

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22.   (original) The method of claim 1 wherein the original digital image includes a luminance component and two chrominance components.

23.   (original) The method of claim 22 wherein the noise filter is used to remove more noise from the chrominance components than the luminance component.

24.   (withdrawn) In a method of removing noise from a digital image, comprising the steps of:

a)   receiving an original digital image including a plurality of pixels;

b)   generating at least one residual digital image and at least one base digital image from the original digital image using wavelet filters or discrete cosine transform filters, the base digital image having a lower spatial resolution than the original digital image; and

c)   generating a noise reduced base digital image by removing noise from the base digital image with a noise reduction filter so that when the noise reduced base digital image is combined with the residual digital image to produce a reconstructed digital image, noise is not present in the reconstructed digital image.

25.   (withdrawn) In a method of removing noise from a digital image, comprising the steps of:

a)   receiving an original digital image including a plurality of pixels;

b)   sequentially generating, starting from the original digital image, a plurality of residual digital images and a plurality of corresponding base digital images, respectively, wherein each base digital image has a lower spatial resolution than the previous digital image from which is was derived; and

c)   generating noise reduced base digital images by removing noise from at least one of the base digital images with a noise reduction filter so that when the noise reduced base digital images are combined with corresponding residual digital images to produce reconstructed digital images, noise is not present in the reconstructed digital images.

26.   (withdrawn) The method of claim 25 wherein a first noise reduction filter is used to remove noise from one of the base digital images and a second noise reduction filter is used to remove noise from a different base digital image.

27. (withdrawn) In a method of removing noise from a digital image comprising the steps of:

a) receiving an original digital image including a plurality of pixels;

b) noise filtering the original digital image to produce a noise reduced original digital image;

c) generating at least one residual digital image and at least one base digital image from the noise reduced original digital image, the base digital image having a lower spatial resolution than the noise reduced original digital image; and

d) generating a noise reduced base digital image by removing noise from the base digital image with a noise reduction filter so that when the noise reduced base digital image is combined with the residual digital image producing a reconstructed digital image, noise is not present in the reconstructed digital image.

28. (withdrawn) The method of claim 27 further including the step of:

e) using the residual digital image and the noise reduced base digital image to produce the reconstructed digital image.

29. (withdrawn) The method of claim 28 wherein the reconstructed digital image has the same spatial resolution as the original digital image.

30. (withdrawn) The method of claim 28 wherein the reconstructed digital image has a lower spatial resolution as the original digital image.

31. (withdrawn) The method of claim 27 further including the steps of:

generating an interpolated noise reduced base digital image by spatially filtering the noise reduced base digital image with an interpolation filter; and

generating the residual digital image by combining the interpolated noise reduced base digital image with the noise reduced original digital image.

32. (withdrawn) The method of claim 31 wherein combining the interpolated noise reduced base digital image with the noise reduced original digital image includes calculating the difference between the interpolated noise reduced base digital image and the noise reduced original digital image.

33.   (withdrawn) The method of claim 32 wherein combining the residual digital image with the interpolated noise reduced base digital image includes calculating the addition of the residual digital image and the interpolated noise reduced base digital image.

34.   (withdrawn) The method of claim 28 wherein the generated base digital image is accomplished by spatially filtering the noise reduced original digital image.

35.   (withdrawn) The method of claim 34 wherein the generated base digital image is accomplished by spatially filtering the noise reduced original digital image using a two-dimensional Gaussian filter.

36.   (withdrawn) The method of claim 34 wherein the generated base digital image is accomplished by spatially filtering the noise reduced original digital image using two one-dimensional Gaussian filters wherein the one-dimensional Gaussian filters are oriented in orthogonal directions to each another.

37.   (withdrawn) The method of claim 34 wherein the generated base digital image is accomplished by spatially filtering the noise reduced original digital image wherein the spatial filtering step is applied to selected pixels of the noise reduced original digital image.

38.   (withdrawn) The method of claim 37 wherein the selected pixels on which spatial filtering is performed on every other pixel of every other row of pixels of the noise reduced original digital image.

39.   (withdrawn) The method of claim 27 wherein the noise reduction filter used to remove noise from the base digital image includes the steps of:

identifying a pixel of interest and a local neighborhood of pixels located about the pixel of interest;

calculating a difference pixel value for pixels in the local neighborhood of pixels based on the absolute difference between the value of the pixel of interest and the individual values of pixels included in the local neighborhood of pixels;

using the absolute difference pixel values to calculate a noise reduced pixel value; and

replacing the value of the pixel of interest with the noise reduced pixel value.

40. (withdrawn) The method of claim 39 further including the steps of:

comparing the absolute difference pixel values to a threshold value; and

using only the values of pixels included in the local neighborhood of pixels for which the corresponding absolute difference pixel values are less than the threshold value to calculate the noise reduced pixel value.

41. (withdrawn) The method of claim 40 wherein the threshold value is a function of the values of pixels included in the local neighborhood of pixels.

42. (withdrawn) The method of claim 27 wherein the noise reduction filter is adaptive and changes in response to the signal content of the pixels values of the digital image.

43. (withdrawn) The method of claim 27 wherein the noise reduction filter is a median filter.

44. (withdrawn) The method of claim 31 wherein the interpolation filter is a bilinear interpolation filter.

45. (withdrawn) The method of claim 31 wherein the interpolation filter is a bicubic interpolation filter.

46. (withdrawn) The method of claim 27 wherein the original digital image includes a luminance component and two chrominance components.

47. (withdrawn) The method of claim 46 wherein the noise filter is used to remove more noise from the chrominance components than the luminance component.

48. (withdrawn) In a method of removing noise from a digital image comprising the steps of:

a) receiving an original digital image including a plurality of pixels;

b) noise filtering the original digital image to produce a noise reduced original digital image;

c) generating at least one residual digital image and at least one base digital image from the noise reduced original digital image using wavelet filters or discrete cosine transform

filters, the base digital image having a lower spatial resolution than the original digital image; and

d)   generating a noise reduced base digital image by removing noise from the base digital image with a noise reduction filter so that when the noise reduced base digital image is combined with the residual digital image to produce a reconstructed digital image, noise is not present in the reconstructed digital image.

49.   (currently amended) In a method of removing noise from a digital image comprising ~~the steps of~~:

a)   receiving an original digital image including a plurality of pixels;

b)   noise filtering the original digital image to produce a noise reduced original digital image;

c)   sequentially generating, starting from the noise reduced original digital image, a plurality of residual digital images and a plurality of corresponding base digital images, respectively, wherein each base digital image has a lower spatial resolution than the previous digital image from which is was derived; and

d)   generating noise reduced base digital images by removing noise from at least one base digital image with a noise reduction filter so that when the noise reduced base digital images are combined with corresponding residual digital images to produce reconstructed digital images, noise is <u>reduced</u>~~not present~~ in the reconstructed digital images <u>as compared to the original digital image</u>.

50.   (original) The method of claim 49 wherein a first noise reduction filter is used to remove noise from one of the base digital images and a second noise reduction filter is used to remove noise from a different base digital image.

51.   (original) A computer storage medium having instructions stored therein causing a computer to perform the method of claim 1.

52.   (withdrawn) A computer storage medium having instructions stored therein causing a computer to perform the method of claim 24.

53.   (withdrawn) A computer storage medium having instructions stored therein causing a computer to perform the method of claim 25.

54.   (withdrawn) A computer storage medium having instructions stored therein causing a computer to perform the method of claim 27.

55.   (withdrawn) A computer storage medium having instructions stored therein causing a computer to perform the method of claim 48.

56.   (withdrawn) An image pyramid representation of an original digital image, comprising:

a)   at least one noise reduced base digital image having lower spatial resolution than an original digital image wherein the base digital image has noise removed therefrom; and

b)   at least one residual digital image so that when the noise reduced base digital image and the residual digital image are combined, they form a reconstructed digital image wherein noise found in the original digital image is not present in the reconstructed digital image.

57.   (withdrawn) A computer storage medium having instructions stored therein causing a computer to perform the method of claim 56.

58.   (new) A method of removing noise from a digital image, comprising:

a)   receiving an original digital image including a plurality of pixels;

b)   considering the original digital image as a starting digital image;

c)   using the starting digital image to generate a base digital image having a lower spatial resolution than the starting digital image;

d)   using the base digital image to generate a corresponding residual digital image;

e)   removing noise from the base digital image to generate a noise reduced base digital image;

f)   generating a multiresolution representation digital image including a set of at least one residual digital image and a set of at least one noise reduced based digital images by repeating procedural operations c) through e) one or more times wherein each repeated procedure considers the noise reduced base digital image from the previous procedure to be the starting digital image for the next procedure; and

h)   using the multiresolution representation digital image to generate a reconstructed digital image having the same or lower spatial resolution than the original digital image.

59.   (new) The method of claim 58 wherein the original digital image is noise filtered

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to remove noise prior to b).

60. (new) A method of removing noise from a digital image, comprising:

a) receiving an original digital image including a plurality of pixels;

b) generating a multiresolution representation digital image from the original digital image including:

i) a plurality of residual digital images having progressively lower spatial resolution; and

ii) a base digital image having a spatial resolution equal to or lower than the lowest spatial resolution residual digital image; and

c) filtering the base digital image to remove noise; and

d) generating a noise reduced original digital image from the multiresolution representation digital image.

61. (new) A method of removing noise from a digital image, comprising:

a) receiving an original digital image including a plurality of pixels;

b) generating a multiresolution representation digital image from the original digital image, wherein the multiresolution representation digital image can be used to reconstruct a digital image equivalent to the original digital image, including:

i) a set of one or more residual digital images having progressively lower spatial resolution; and

ii) a base digital image having a spatial resolution equal to or lower than the lowest spatial resolution residual digital image; and

c) generating a noise reduced original digital image from the multiresolution representation digital image without noise filtering the plurality of residual digital images.

62. (new) A method of removing noise from a digital image, comprising:

a) receiving an original digital image including a plurality of pixels;

b) generating a multiresolution representation digital image from the original digital image including:

i) a set of one or more of residual digital images having progressively lower spatial resolution; and

ii) a base digital image having a spatial resolution equal to or lower than the lowest spatial resolution residual digital image; and

c) generating a noise reduced reconstructed digital image from the multiresolution representation digital image by:

    i) considering the base digital image as a starting digital image;

    ii) removing noise from the starting digital image to generate a noise reduced base digital image;

    iii) generating a reconstructed base digital image by combining the noise reduced base digital image with the residual digital image having the corresponding spatial resolution;

    iv) considering the reconstructed base digital image as a starting digital image; and

    v) repeating operation c)ii) through c)iv) until the reconstructed base digital image is of the same or lower spatial resolution as the original digital image.

63. (new) A method of removing noise from a digital image, comprising:

a) receiving an original digital image including a plurality of pixels;

b) generating a multiresolution representation digital image from the original digital image having a set of progressively lower spatial resolution grouplet wherein each grouplet includes a base digital image and one or more corresponding residual digital images; and

c) generating a reconstructed noise reduced original digital image from the multiresolution digital image, starting with the lowest spatial resolution grouplet, by iteratively:

    i) generating a noise reduced base digital image by removing noise from the base digital image with a noise filter; and

    ii) generating a reconstructed base digital image, of higher spatial resolution than the base digital image by combining the noise reduced base digital image with the residual digital images from the next higher spatial resolution grouplet, and

    iii) considering the reconstructed base digital image as the base digital image for the next iteration.

64. (new) A method of reducing noise in an original digital image having a plurality of pixels, comprising:

a) decomposing the original digital image into a multiresolution respresentation digital image including a set of residual digital images at multiple spatial resolutions and a base digital image, wherein a reconstructed image equivalent to the original digital image can be generated from the multiresolution representation digital image;

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b)   removing noise from the base digital image by applying a noise filter; and

c)   using the multiresolution representation to generate a reconstructed digital image that has less noise than the original digital image.

65.   (new) A method of reducing noise in an original digital image having a plurality of pixels, comprising:

a)   decomposing the original digital image into a multiresolution representation digital image including a set of residual digital images at multiple spatial resolutions and a base digital image, wherein a reconstructed image equivalent to the original digital image can be generated from the multiresolution representation digital image; and

b)   using the multiresolution representation to generate a reconstructed digital image that has less noise than the original digital image by iteratively:

i) removing noise from the base digital image to generate a noise reduced base digital image;

ii) using the corresponding spatial resolution residual digital image and the noise reduced base digital image to generate a base digital image of higher spatial resolution than the noise reduced base digital image.

66.   (new) A method of reducing noise in an original digital image having a plurality of pixels, comprising:

a)   decomposing the original digital image into a multiresolution representation digital image including a set of residual digital images at multiple spatial resolutions and a base digital image, wherein a reconstructed image equivalent to the original digital image can be generated from the multiresolution representation image by, starting with the original digital image, iteratively:

i) removing noise from the starting digital image to generate a noise reduced base digital image;

ii) filtering the noise reduced base digital image to generate a smaller base digital image having a lower spatial resolution than the noise reduced base digital image;

iii) using the noise reduced base digital image to generate a corresponding residual digital image; and

iv) considering the smaller base digital image as the starting digital image for the next iteration; and

b)   using the multiresolution representation to generate a reconstructed digital image

that has less noise than the original digital image.

67.   (new) A method of constructing a multiresolution representation for a digital image, comprising:

a)   receiving an original digital image including a plurality of pixels;

b)   generating a multiresolution representation digital image from the original digital image having:

i) a set of one or more of noise reduced base digital images having progressively lower spatial resolution, wherein each noise reduced base digital image is generated by filtering a digital image having a higher spatial resolution and applying a noise filter to that base digital image to remove noise; and

ii) a set of one or more residual digital images having progressively lower spatial resolution, wherein at least one of the residual digital images is generated from a noise reduced base digital image.

68.   (new) A method of constructing a multiresolution representation for a digital image, comprising:

a)   receiving an original digital image including a plurality of pixels; and

b)   generating a multiresolution representation digital image from the original digital image having a set of one or more noise reduced base digital images having progressively lower spatial resolution, and a set of one or more residual digital images having progressively lower spatial resolution, by iteratively;

i.   generating a base digital image from the original digital image;

ii.   removing noise from the base digital image using a noise filter to generate a noise reduced base digital image;

iii.   generating a residual digital image from the noise reduced base digital image; and

iv.   considering the noise reduced base digital image from the previous iteration as a starting digital image for a next iteration.